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**KEEPING THE FUTURE BRIGHT: DEPARTMENT OF DEFENSE (DOD)
SUSTAINABLE ENERGY STRATEGY FOR INSTALLATIONS**

By

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Lieutenant Colonel, U.S. Army

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SUSTAINABLE ENERGY STRATEGY FOR INSTALLATIONS**

by

Kenneth N. Reed

Lieutenant Colonel, U.S. Army

A paper submitted to the Faculty of the Joint Advanced Warfighting School in partial satisfaction of the requirements of a Master of Science Degree in Joint Campaign Planning and Strategy. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Joint Forces Staff College or the Department of Defense.

This paper is entirely my own work except as documented in footnotes.

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Abstract

The energy crisis of the 1970s brought an abrupt halt to the euphoric age of relatively cheap and abundant energy for the United States (US). Energy availability became a national security issue prompting a concerted national campaign to achieve energy independence and assure energy availability. As the Federal agency responsible for assuring national security and the largest consumer of energy in the Federal government, DOD developed an energy strategy focused on assuring energy independence and availability while fulfilling Federal energy goals.

This research addressed the ability of DOD's installation sustainable energy strategy to achieve Federal energy goals while supporting the nation's energy independence and availability efforts. An examination of the US energy situation from 1970–2015, a thorough literature review, and an analysis of DOD's current installation energy strategy revealed that DOD has only made satisfactory progress in 3 of 5 Federal energy goals. Despite significant improvements in reducing energy demands, increasing energy supply through renewable sources, and adapting the future force, DOD will remain deficient in achieving Federal energy goals unless the political, economic, and cultural risk factors impeding strategy implementation are addressed.

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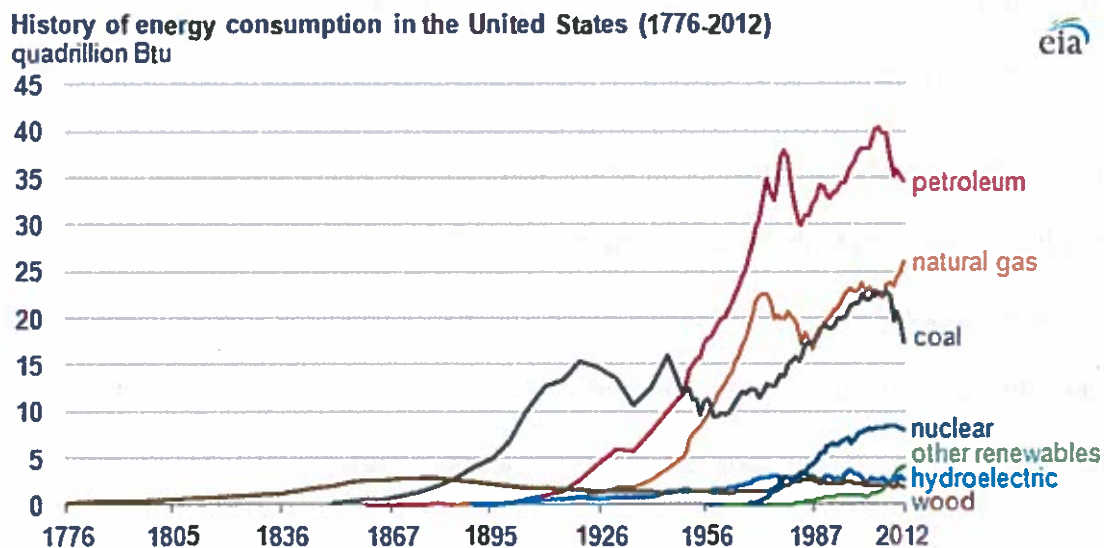
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Chapter 1- Introduction

1.1 Background

The Industrial Revolution transformed the world as wood, coal, and gas powered machines replaced man and labor in driving mass production. In the United States (US), energy demand increased exponentially in the twentieth century as the nation evolved into a global super power (See Figure 1). The early twentieth century was a euphoric era of relatively cheap and abundant energy for the US. The nation's energy consumption patterns changed as new energy sources emerged with petroleum becoming the primary energy source.¹

Figure 1: History of Energy Consumption in the United States (1776-2012)



Source: US Energy Information Administration

¹ U.S. Energy Information Administration, "Energy sources have changed throughout the history of the United States," <http://www.eia.gov/todayinenergy/detail.cfm?id=11951> (accessed November 6, 2015).

The euphoric era of relatively cheap and abundant energy came to an abrupt halt in 1973. During the October 1973 Arab-Israeli War, the Arab members of the Organization of Petroleum Exporting Countries (OPEC) announced an embargo against the US in response to the US decision to re-supply the Israeli military during the war. The embargo banned petroleum exports and introduced cuts in oil production.² The petroleum embargo in conjunction with dwindling domestic petroleum reserves and a dependence on imported petroleum sparked the nation's first energy crisis.

Prior to the 1970s energy crisis, the Federal government played a limited role in formulating the national energy policy. The nation relied on the private sector to fulfill most of its energy needs. Historically, Americans expected private industry to establish production, distribution, marketing, and pricing policies. However, when free market conditions were absent, Federal regulations were established to control energy pricing.³ As a result of the 1970s energy crisis, energy availability became an economic and national security issue.

In 1977, the Federal government's inaugural comprehensive and balanced national energy plan commenced with the establishment of the Department of Energy (DOE). DOE's establishment facilitated the development of Federal energy policies and programs through better coordination between the executive and legislative branches.⁴ President Carter elevated the energy availability discussion during a televised energy

² ProCon.org, "History of Alternative Energy and Fossil Fuel," <http://alternativeenergy.procon.org/view.timeline.php?timelineID=000015> (accessed October 12, 2015).

³ U.S. Department of Energy: Office of Management, "A Brief History of the Department of Energy," <http://energy.gov/management/office-management/operational-management/history/brief-history-department-energy> (accessed October 11, 2015).

⁴ Ibid.

policy speech in 1977. The President declared that energy conservation was “the moral equivalent of war.”⁵ In the late 1970s, the Carter administration initiated an energy campaign focused on conservation and procurement of sustainable energy sources with a desired end state of ensuring energy availability.

Throughout the 1970s, Congress began mandating reductions in energy consumption by Federal agencies. The early legislation focused primarily on improving Federal building efficiencies by mandating a 10 % reduction in energy consumption and reducing fossil fuel use.⁶ However, the Federal government recognized that energy conservation alone was inadequate for ensuring energy availability. As a result, the Federal government created legislation mandating the use of alternative energy sources for Federal agencies and presented incentives for industry to use alternative energy sources.⁷ This energy legislation set the US on a path of achieving energy independence and assisted in insulating the nation from risks associated with the lack of energy availability.

Today, the Federal government’s energy policy portfolio is interwoven throughout American daily life impacting the economy and US National Security. DOD is the Federal government’s single largest consumer of energy and is influenced by energy availability more than any other Federal agency. DOD accounts for approximately 80 % of the government’s energy consumption.⁸ In 2014, DOD’s total energy bill was \$18.2

⁵ Jimmy Carter, “The President’s Proposed Energy Policy,” http://alternativeenergy.procon.org/sourcefiles/Carter%27s_Speech.pdf (accessed October 12, 2015).

⁶ Congressional Research Service, *Department of Defense Facilities Energy Conservation Policies and Spending*, United States Senate, by Congressional Research Service, December 2008 (Washington DC: Government Printing Office, 2008), 1.

⁷ *Energy Policy Act of 1992*, HR 776, 102nd Cong., 2nd sess., (3 January 1992): Title III, SEC 306.

⁸ U.S. Energy Information Administration, “Defense Department energy use falls to lowest level since at least 1975,” U.S. Energy Information Administration, <http://www.eia.gov/todayinenergy/detail.cfm?id=19871> (accessed November 6, 2015).

billion (\$4.2 billion for installation energy and \$14 billion for operational energy).⁹

Installation energy only accounts for 30 % of DOD's total energy consumption; however, the Department's ability to project combat power is directly linked to maintaining functioning installations.¹⁰ In recognition of the risks, DOD aggressively pursued a sustainable energy strategy for thousands of installations worldwide. DOD defines sustainable energy as the form of energy obtained from non-exhaustible resources that serves the present energy needs without compromising the ability of future generations to meet their energy needs.¹¹

1.2 Problem Statement

The energy crisis of the 1970s drove the US to seek new and innovative ways to ensure energy availability. The way forward commenced with Federal legislation. The National Energy Conservation Policy Act 1978 (NECPA) launched a concerted national effort to provide for the regulation of interstate commerce, to reduce the growth in demand for energy in the US, and to conserve nonrenewable energy resources produced in this Nation and elsewhere, without inhibiting beneficial economic growth.¹² NECPA was a great initiative in reducing energy use; however, it failed to address the demand for increased energy supplies.

⁹ U.S. Department of Defense, *Department of Defense Annual Energy Management Report Fiscal Year 2014*, U.S. Department of Defense, (Washington DC, 2015), 17.

¹⁰ Ibid.

¹¹ Xavier Lemaire, "Glossary of terms in sustainable energy regulation," *Renewable Energy and Efficiency Partnership (August 2004)*: 10, <http://www.reeep.org/sites/default/files/Glossary%20of%20Terms%20in%20Sustainable%20Energy%20Regulation.pdf> (accessed November 6, 2015).

¹² *National Energy Conservation Act of 1978*, HR 5037, 95th Cong., (9 November 1978): SEC 102 (b).

In conjunction with NECPA's conservation efforts, the US needed alternative sustainable energy sources to address the supply requirements of a growing industrialized nation. In the early 1990s, the Federal government addressed the energy supply requirement with legislation and executive orders mandating the use of sustainable energy sources with goals and objectives focused on increasing energy supplies.¹³ The Federal mandates solidified the requirement for the nation to pursue sustainable energy opportunities. National mandates placed the US on a trajectory for achieving energy independence focused on ensuring energy availability.¹⁴ However, questions remained about the strategy required to achieve energy independence and availability.

As the Federal government's largest consumer of energy, DOD had a vested interest in achieving energy independence and availability. DOD is responsible for having defense installations and facilities in the right place, at the right time, with the right qualities and capacities to protect national resources.¹⁵ DOD's efforts to keep America safe are dependent on maintaining reliable, uninterrupted energy to installations and facilities consisting of several hundred thousand individual buildings and structures located at more than 5,000 different locations covering over 30 million acres of land.¹⁶

As demonstrated through various forms of legislation, the US recognized the benefits of sustainable energy sources in the nation's long term energy independence and availability efforts. DOD also recognized the benefits of sustainable energy sources as the department developed and implemented an installation sustainable energy strategy. While

¹³ *Energy Policy Act of 1992*, HR 776, 102nd Cong., 2nd sess., (3 January 1992): Title XII, SEC 1201.

¹⁴ *Energy Policy Act of 2005*, HR 6, 109th Cong., 1st sess., (4 January 2005), Titles I-XVIII.

¹⁵ U.S. Department of Defense, "*About the Department of Defense (DoD)*," U.S. Department of Defense, <http://www.defense.gov/About-DoD> (accessed November 6, 2015).

¹⁶ *Ibid.*

the legislation was a good start towards expanding the energy supply and reducing demand, DOD's ability to achieve Federal energy goals are degraded. This research addressed DOD's installation sustainable energy strategy efforts to achieve Federal energy goals while supporting the nation's energy independence and availability efforts.

1.3 Methodology and Research Objective

The methodology and analysis used to research the problem surrounding DOD's installation sustainable energy strategy includes a comprehensive literature review and analysis of legislation, reports, and studies. The research provides a comprehensive analysis of the current DOD installation sustainable energy strategy; the service components' installation sustainable energy efforts; and the political, economic, and cultural risks to the strategy implementation. The research findings are provided with an assessment of the current strategy with recommendations and opportunities for strategy adjustments.

Chapter 2 – Legislation and Mandates

2.1 Background on Sustainable Energy Evolution

In the early 1990s, the drive to achieve energy independence sparked the growth in the sustainable energy industry throughout the US. Technologies that promoted sustainable energy included renewable energy sources, such as hydroelectricity, solar energy, wind energy, wave power, geothermal energy, bioenergy, tidal power and also technologies designed to improve energy efficiency.¹ Over time, government policies enabled economic competitiveness between most sustainable energy technologies and non-renewable energy sources.² The government's policies are improving investor confidence resulting in market expansion.

While the first large wind farms were installed 35 years ago, wind energy really began to surge in 2000, as wind costs dipped into the cost-competitive range of 5 to 10 cents per kilowatt hour (¢/KWh)(See Figure 2).³ Since then, wind installations increased substantially, and now provide more than 65 gigawatts (GW) of installed capacity with another 13.6 GW of capacity in development. Wind is poised to overtake hydroelectric

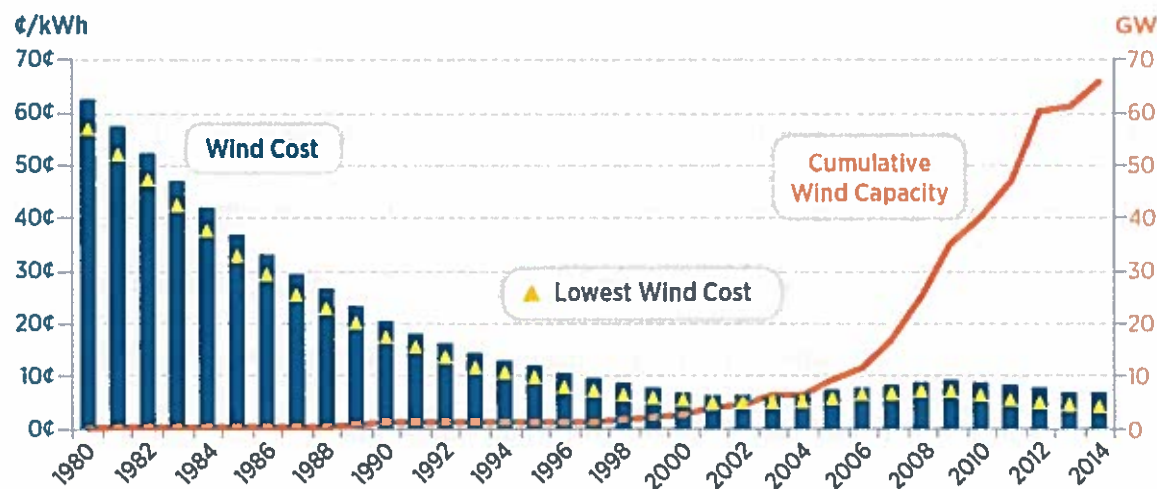
¹ U.S. Energy Information Administration, *Annual Energy Outlook 2015 with projections to 2040*, U.S. Energy Information Administration, (Washington DC, 2015).

² U.S. Department of Energy, "Revolution Now: The Future Arrives for Five Clean Energy Technologies—2015 Update," <http://energy.gov/eere/downloads/revolution-now-future-arrives-five-clean-energy-technologies-2015-update> (accessed 14 November 2015).

³ U.S. Department of Energy, "6 Charts that Will Make You Optimistic about America's Clean Energy Future," <http://energy.gov/articles/6-charts-will-make-you-optimistic-about-america-s-clean-energy-future> (accessed 14 November 2015).

power as America's number one source of renewable energy, accounting for 4.4 % of total US electricity generation.⁴

Figure 2: Land-Based Wind Power



Source: U.S. Department of Energy

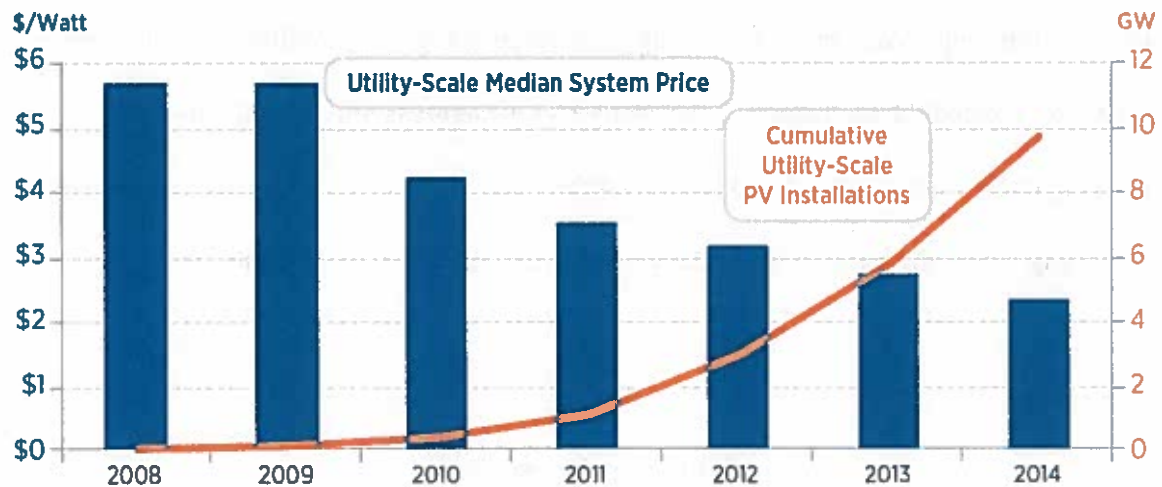
The rise of solar photovoltaic (PV) energy from a novelty to a mainstream energy source represents another one of the biggest clean energy stories of the past decade. Since 2008, the cost of installing utility-scale PV dropped from \$5.70 per Watt of generating power in 2008 to only \$2.34 per Watt in 2014, a reduction of almost 60 % enabling PV to be cost competitive with conventional generation in parts of the US.⁵ The staggering growth in PV installed capacity, from almost none in 2008 to nearly 10 GW in 2014, is remarkable. The Energy Department's Loan Programs Office efforts increased the install trend. In the first half of 2015, 15 % of new electric generation capacity of any kind (renewable, nuclear or fossil) was utility-scale solar power. With a mammoth 27 GW of

⁴ Ibid.

⁵ Ibid.

utility-scale solar projects currently in development, solar capacity will increase in the coming years (See Figure 3).⁶

Figure 3: Solar PV (Utility Scale)



Source: U.S. Department of Energy

The distributed solar energy market is also increasing in use as the entry cost barrier for residential consumers with sunny roofs is decreasing rapidly. Although still slightly more expensive to install than utility-scale PV, distributed solar installation costs decreased in half since 2008, and this power source increased from less than a GW of production to nearly 10 GW in late 2015, which represents almost 800,000 installations.⁷ Historically, distributed PV has been privately purchased and installed. However, utility companies are beginning to purchase and install solar panel systems on homes and businesses. This allows the individual to benefit from lower utility rates without the high

⁶ Ibid.

⁷ Ibid.

up-front installation and hardware costs. This new initiative accounted for more than 72 % of U.S. residential solar installations in 2014.⁸

Over the past three decades, considerable progress occurred in transitioning from fossil fuels to sustainable energy sources. Conservation efforts reduced overall energy consumption, improvements in technology increased energy availability, and adaptive legislation created the environment for change. DOD aggressively adapted to the changing energy environment and embraced the Federal goals set by legislation focused on moving closer to energy independence and availability for its installations.

2.2 Energy Legislation

2.2.1 The National Energy Conservation Policy Act 1978 (NECPA)

NECPA legislation started the energy independence and availability campaign for the US after the energy crisis of the 1970s. When developing NECPA, Congress recognized that the US faced an energy shortage arising from an increased demand for energy coupled with a dependency on the world oil market that required all sectors of the Nation's economy to reduce energy use immediately.⁹ NECPA primarily addressed conservation efforts focused on reducing energy consumption. However, Sec. 522 Federal Solar Program of the legislation explored the use of solar energy sources in Federal buildings.¹⁰ DOD's vast inventory of buildings at fixed installations contributed immensely in achieving the NECPA goals.

⁸ Ibid.

⁹ *National Energy Conservation Act of 1978*, SEC 102(a).

¹⁰ Ibid., SEC 522.

2.2.2 The Energy Policy Act of 1992 (EPAct 1992)

EPAct 1992 set goals, created mandates, and amended utility laws to increase clean energy use and improve overall energy efficiency in the US. The Act consisted of twenty-seven titles detailing various measures designed to lessen the nation's dependence on imported energy, provide incentives for clean and renewable energy, and promote energy conservation in buildings.¹¹ EPAct 1992 directed the Federal government to increase energy conservation in Federal buildings when feasible, and to integrate the use of alternative fuel vehicles in Federal and state fleets. The legislation authorized DOD to seek alternative energy sources while continuing to mandate improved energy conservation efforts. EPAct 1992 also mandated that 75 % of Light Duty Vehicles acquired by DOD be alternative fuel vehicles.¹² Through focused efforts, DOD achieved the EPAct 1992 goals in 2014.

2.2.3 The Energy Policy Act of 2005 (EPAct 2005)

Competing concerns about energy security, environmental quality, and economic growth shaped EPAct 2005. Despite the efforts of previous energy legislation, the US continued to face rising energy prices and growing dependence on foreign oil. EPAct 2005 progressed US energy legislation focused on ensuring energy availability for the US. The legislation addressed energy efficiency, renewable energy, oil and gas, coal, nuclear power, vehicles and fuel, hydrogen, research and development, electricity, tax incentives, ethanol and motor fuel. The major provisions of the legislation in relation to DOD's installation sustainable energy strategy were energy tax incentives, energy

¹¹ Energy Policy Act of 1992, Title I.

¹² Ibid., Title III, Sec 301.

efficiency standards, and domestic energy production.¹³ The tax incentives were vital to gaining private sector interest in advancing energy technology development. EPAct 2005 set the baseline goals for DOD's installation sustainable energy strategy. Diversifying the energy supply, coupled with increasing energy efficiency and conservation efforts, put DOD on the path to energy independence and availability. Unfortunately, the Department is currently hindered from fully achieving the EPAct 2005 goals due to the economic risk factor.¹⁴

2.2.4 The Energy Independence and Security Act 2007 (EISA 2007)

EISA 2007 was the next series of Federal legislation focused on achieving energy independence and availability for the US. The aims of EISA 2007 were to:¹⁵

- Move the US toward greater energy independence and security.
- Increase the production of clean renewable fuels.
- Protect consumers.
- Increase the efficiency of products, buildings, and vehicles.
- Promote research on and deploy greenhouse gas capture and storage options.
- Improve the energy performance of the Federal Government.
- Increase U.S. energy security, develop renewable fuel production, and improve vehicle fuel economy.

The legislation reinforced the energy reduction goals for Federal agencies and introduced more aggressive requirements. For example, Section 431 of EISA 2007 increased the Federal energy reduction goal from 2 % per year (as established by EPAct 2005) to 3% per year, with a new target of 30% greater efficiency by 2015. Section 523 required that at least 30% of the hot water demand for each new Federal building (or major renovations to existing Federal buildings) be met through the use of solar hot water

¹³ *Energy Policy Act of 2005*, Titles I-XVIII.

¹⁴ See Chapter 5.1 for details on the economic risk factor hindering goal achievement.

¹⁵ *Energy Independence and Security Act of 2007*, HR 6, 110th Cong., 1st sess., (4 January 2007), Title I-XVI.

heating if life-cycle cost-effective.¹⁶ The legislation's impact to DOD's sustainable energy strategy for installations increased conservation efforts and the emphasis on the use of solar energy as a sustainable energy resource.¹⁷ Currently, the Department's ability to fully achieve EISA 2007 goals are hindered by political and economic risk factors.¹⁸

2.2.5 National Defense Authorization Act of 2007 (NDAA 2007)

The NDAA 2007, legislation specific to DOD, aimed to reduce the department's dependence on foreign oil, increase energy supply diversity and security, reduce energy costs, accelerate technology development, and reduce environmental impacts. The legislation required DOD to produce or procure 25 % of all energy from renewable sources by 2025 and to meet energy performance goals for the Department's military transportation, support systems, and installations consistent with the EPAct 2005 goals.¹⁹ The Act was the first legislation to establish energy performance goals with an associated performance plan requirement for DOD. NDAA 2007, in conjunction with existing legislation such as the EPAct 2005, continued to provide DOD with guidance for the Department's installation sustainable energy strategy.

¹⁶ Ibid., Sec 431 and Sec 523.

¹⁷ After 2015, Executive Order 13693 reduced the energy reduction goal from 3% to 2.5% until 2025.

¹⁸ See Chapter 5.1 for details on the political and economic factors hindering goal achievement.

¹⁹ *John Warner National Defense Authorization Act for Fiscal Year 2007*, HR 5122, 109th Cong., 2nd sess., (3 January 2006), Sec. 2852 & 2911.

2.3 Mandates for Federal Agencies

2.3.1 Executive Order (EO) 13123 – Greening the Government through Efficient Energy Management

Effective 3 June 1999, this EO mandated all Federal agencies to improve the energy efficiency of their buildings, promote the use of renewable energy, and reduce greenhouse gas emissions associated with energy use in their buildings. The EO built on the work initiated under EPCA 1992 and set the path for future legislation. The EO focused primarily on the Federal government leading the Nation in energy management efforts. The EO established seven goals:²⁰

- Greenhouse Gases Reduction Goal. Each agency shall reduce its greenhouse gas emissions attributed to facility energy use by 30 % by 2010 compared to such emissions levels in 1990.
- Energy Efficiency Improvement Goals. Each agency shall reduce energy consumption per gross square foot of its facilities by 30 % by 2005 and 35 % by 2010 relative to 1985.
- Industrial and Laboratory Facilities. Each agency shall reduce energy consumption per square foot, per unit of production, or per other unit as applicable by 20 % by 2005 and 25 % by 2010 relative to 1990.
- Renewable Energy. Each agency shall strive to expand the use of renewable energy within its facilities and in its activities by implementing renewable energy projects and by purchasing electricity from renewable energy sources.
- Petroleum. Each agency shall reduce the use of petroleum within its facilities.
- Source Energy. Each agency shall strive to reduce total energy use and associated greenhouse gas and other air emissions, as measured at the source.
- Water Conservation. Agencies shall reduce water consumption and associated energy use in their facilities.

²⁰ President, Executive Order, "Greening the Government through Efficient Energy Management," *Federal Register* Vol. 64, No. 109 (June 8, 1999): 30851-30852.

The EO provided DOD with additional guidelines for the development, implementation, and assessment of the Department's installation sustainable energy strategy. Although EO 13423 superseded EO 13123, the major provisions of EO 13123 are continued in EO 13693.

2.3.2 Executive Order (EO) 13693 – Planning for Federal Sustainability for the Next Decade

Effective 25 March 2015, EO 13693 continued to emphasize the Federal leadership required to drive national greenhouse gas reductions and support preparations for the impacts of climate change. The EO outlines the opportunity to reduce agency direct greenhouse gas emissions by at least 40 % over the next decade while at the same time fostering innovation, reducing spending, and strengthening the communities in which our Federal facilities operate. The primary mandates of the EO required that Federal agencies acquire 25% of all energy from renewable sources, Federal buildings reduce energy use by 2.5% a year and water intensity by 2% a year, and that Federal fleets reduce per-mile greenhouse gas emissions to 30% of 2014 levels.²¹ In conjunction with other legislation, EO 13693 sets the future course of DOD's installation sustainable energy strategy.

²¹ President, Executive Order, "Planning for Federal Sustainability in the Next Decade," *Federal Register* Vol. 80, No. 57 (March 25, 1999): 15871-15876.

2.4 DOD Reports and Guidance

2.4.1 Defense Science Board (DSB) Task Force on DOD Energy Strategy Report

In an effort to maintain positive progress toward achieving energy independence and availability, DOD directed the DSB to form a Task Force and examine DOD's energy strategy. In 2008, the Task Force completed the investigation covering a range of issues that coalesced into four broad areas:²²

- Identify opportunities to reduce fuel demand by deployed forces and assess the effects on cost, operations and force structure.
- Identify opportunities to deploy renewable and alternative energy sources for facilities and deployed forces.
- Identify institutional barriers to making the transitions recommended by the Task Force, and recommend programs to reduce energy use.
- Identify the potential national benefits from DOD deployment of new energy technologies.

The Task Force arrived at six findings and five recommendations with numerous supporting tasks needed to fully implement the recommendations. Overall, the report revealed that DOD was not properly managing the department's energy risk. As a result, DOD used the task force's findings and recommendations to develop the Department's current installation sustainable energy strategy.

2.4.2 DOD Energy Management Policies

DOD established policies designed to comply with regulatory guidelines set forth by legislation and EOs relating to energy management. The two primary policy documents published by DOD in regards to installation energy use were DOD Instructions (DODI)

²² U.S. Department of Defense, Defense Science Board Task Force, *Report on Defense Science Board Task Force on DoD Energy Strategy: More Fight - Less Fuel*, U.S. Department of Defense, (Washington DC, 2008), 9.

4170.11 and DOD Directive (DODD) 4180.01, which covers installation energy program management.

In 2009, DOD published DODI 4170.11 outlining the guidance for the military services to meet the regulatory guidelines set forth in legislation relating to energy efficiency in installation energy management. DODI 4170.11 established goals to modernize infrastructure, increase utility and energy conservation, enhance demand reduction, and improve energy flexibility, thereby saving taxpayer dollars and reducing emissions that contribute to air pollution and global climate change.²³ DODI 4170.11 also allowed DOD service components the leeway to manage their own energy programs to meet the requirements of the policy instruction as long as the primary objectives of improving energy efficiency and eliminating energy waste while maintaining reliable utility service are accomplished.

In 2014, DOD published DODD 4180.01 as the Department's latest energy policy directive to enhance military capability, improve energy security, and mitigate costs in its use and management of energy.²⁴ The directive demonstrated DOD's commitment to assisting in the nation's energy independence and availability efforts as the Federal government's largest consumer of energy. As a result, DOD's energy management policies, such as DODI 4170.11 and DODD 4180.01, provided guidance to key stakeholders responsible for the implementation of the Department's energy policy.

²³ U.S. Department of Defense, *DOD Instruction 4170.11: Installation Energy Management*, (Washington DC: Department of Defense, 11 December 2009), 10.

²⁴ U.S. Department of Defense, *DOD Directive 4180.01: DOD Energy Policy*, (Washington DC: Department of Defense, 16 April 2014), 1.

Chapter 3 – Current DOD Installation Sustainable Energy Strategy

3.1 DOD Installation Sustainable Energy Strategy

In recent years, a number of factors compelled the US to reduce fossil fuel dependence through investment in renewable energy and energy efficiency, including supply risks, high and volatile oil prices, and environmental impacts. The government's efforts at setting an example in transitioning to advanced energy technologies were especially notable at DOD. Being the largest energy user within the Federal government, DOD faced unique strategic issues associated with energy. Over the last decade, reports cited the military's traditional energy approach and its fossil fuel dependence in particular as a strategic risk and identified renewable energy and energy efficiency investments as key risk mitigation measures.¹

The energy program's first priority is supporting DOD's ability to protect the national security. The Department recognized that installation energy is a critical vulnerability across the full range of military operations. As an enabler, installation energy availability and resilience defined the capabilities of facilities and equipment. Energy remained a substantial expense competing with other DOD investments such as people and equipment. In 2014, DOD's installation energy use accounted for approximately 30 % of the Department's total energy use at a cost of \$4.2 billion. This competition for resources

¹ American Council of Renewable Energy, "U.S. Department of Defense & Renewable Energy: An Industry Helping the Military Meet its Strategic Energy Objectives," <http://www.acore.org/wp-content/uploads/2012/01/DoD-Renewable-Energy-Primer.pdf> (accessed November 27, 2015).

compelled DOD to pursue cost-effective measures to increase energy performance and reduce the cost of operations.²

The Department developed an installation sustainable energy strategy designed to assure energy independence and availability. The strategy consisted of three integrated pillars focused on Expanding Supply, Reducing Demand, and Adapting Future Forces and Technology.³ Expanding the energy supply through the use of sustainable sources, reducing the energy demand through conservation efforts, and adapting the future forces and technologies are the ways to achieving the strategy ends of enhanced capability, mitigated costs, and decreased risk (energy security) as outlined in DODD 4180.01. The sustainable energy strategy is DOD's roadmap to achieve energy independence and availability.

DOD acknowledged that sustainability is not an individual departmental program; rather, it is an organizing paradigm that applies to all DOD mission and program areas. The Department also stated that its commitment to using renewable energy sources is not only because it is dedicated to showing leadership in sustainability, but because on-site renewable energy and storage improves resilience and thus mission readiness.⁴ As a result of this commitment, DOD's installation sustainable energy strategy solicited the ingenuity of industry to accelerate the deployment of advanced energy technologies improving the Department's ability to fulfill its core mission.

² U.S. Department of Defense, *Department of Defense Annual Energy Management Report Fiscal Year 2014*, U.S. Department of Defense, (Washington DC, 2015), 7.

³ Ibid.

⁴ U.S. Department of Defense, *Department of Defense: Strategic Sustainability Performance Plan FY 2014*, U.S. Department of Defense (Alexandria, 2014), 3.

DOD seized opportunities leveraging its fixed installations as ideal test beds for next-generation energy technologies developed by industry, DOE, and university laboratories, filling the gap between research and broad commercial deployment. For example, DOD partnered with industry to test advanced microgrid technology at Marine Corps Air Ground Combat Center (MCAGCC) Twenty-nine Palms, California in the austere Mojave Desert.⁵ The test allowed the base to transform its disparate electrical infrastructure in an optimal way enabling operations independent of the commercial power grid if required.⁶ These partnerships are building energy resiliency at DOD's installations. DOD also leveraged its vast inventory of building types at installations in multiple climate zones across the US for exceptional opportunities to assess the technical validity, operating costs, and environmental impact of advanced, pre-commercial technologies.⁷ The test bed approach is key to the success of DOD's sustainability energy strategy. The approach allows DOD to leverage technology advances from the private sector while benefiting from the lower costs that occur once the private sector commercializes the technologies. DOD's efforts are an essential element of the national strategy to develop and deploy the next generation of energy technologies needed to support the nation's infrastructure.

Overall, the aim of DOD's current installation sustainable energy strategy is to enhance capability, mitigate costs, and decrease risk (energy security). As demonstrated in DOD's test bed approach, the Department's energy strategy incorporated cutting edge

⁵ *Department of Defense Annual Energy Management Report Fiscal Year 2014*, 48.

⁶ The advance microgrid gives the base the ability to operate on or off the commercial power grid increasing the energy availability.

⁷ *Department of Defense: Strategic Sustainability Performance Plan FY 2014*, U.S. Department of Defense (Alexandria, 2014), 3.

technological advances along with proven conservation techniques. However, the long term success of DOD's installation sustainable energy strategy depends on the integration of the service components' efforts and addressing the political, economic, and cultural risk factors hindering complete strategy implementation.

3.2 Army Installation Energy Supporting Efforts

Of the service components, the Army is the largest consumer of installation energy, accounting for 36 % of DOD's total installation energy use.⁸ As a result, the Army developed a comprehensive installation energy management program nested with DOD's installation sustainable energy strategy and codified in the Army's Energy and Water Campaign Plan for Installations. The Campaign Plan defined actions and short, mid, and long-term methods, tools, technologies, and projects required to ensure the Army successfully achieved long-range energy and water goals providing a more secure energy independent future.⁹ The Campaign Plan set the general direction for the Army with five major initiatives: Eliminate Energy Waste in Existing Facilities, Increase Energy Efficiency in New Construction and Renovations, Reduce Dependence on Fossil Fuels, Conserve Water Resources, and Improve Energy Security.¹⁰

The Assistant Secretary of the Army for Installations, Energy and Environment (ASA (IE&E)) chairs the Army's Senior Energy and Sustainability Council (SESC). The SESC

⁸ U.S. Department of Energy, National Renewable Energy Laboratory, *Lessons Learned from Net Zero Energy Assessments and Renewable Energy Projects at Military Installations*, by Michael Callahan, U.S. Department of Energy (Golden, 2011), 9.

⁹ Department of the Army, *Army Energy and Water Campaign Plan for Installations*, Department of the Army (Washington DC, 2007), i.

¹⁰ Ibid.

functions as the overall governance of the Army's energy management efforts and provides strategic direction to integrate energy and water sustainability initiatives into Army plans and policies to meet Army's missions and objectives while contributing to DOD's sustainable energy strategy approach.¹¹ Unfortunately, the Army failed to completely fulfill the Federal energy goals due to political, economic, and cultural risk factors hindering complete strategy implementation.

Expand Supply

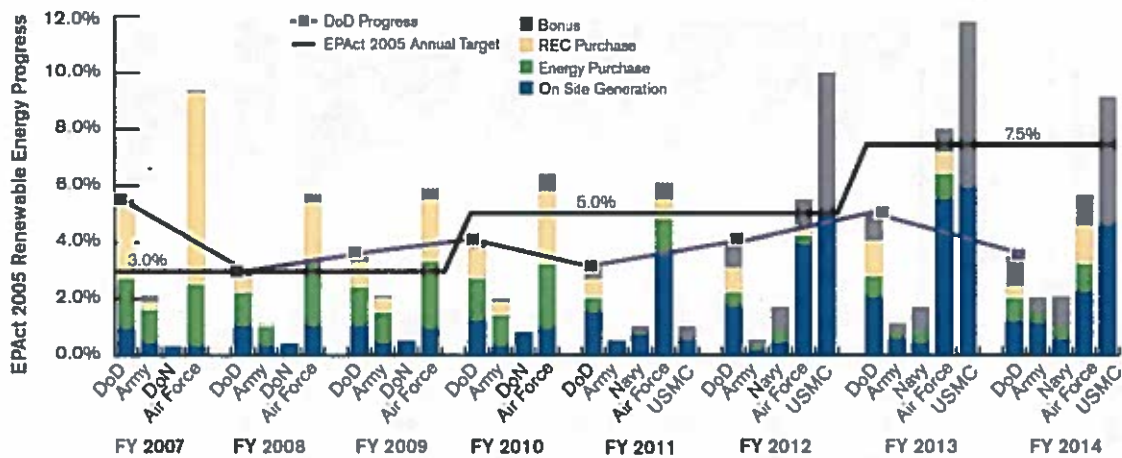
The Army failed to achieve the EAct 2005 renewable energy goal of 7.5 % in FY 2014, consuming only 2 % of electricity from renewable energy sources.¹² However, the diligent efforts of the Army Office of Energy Initiative (OEI) in partnering with Army installations to implement cost-effective, large-scale renewable energy projects and leverage private sector financing nearly doubled the Army's percentage from FY 2013 and will continue to improve its EAct 2005 renewable energy performance (See Figure 4). The Army has over 350 renewable energy projects producing electricity and continues to develop small and large scale projects contributing to achievement of the EAct 2005 renewable energy goal and the renewable energy target established as part of the December 5, 2013, Presidential Memorandum.¹³

¹¹ *Department of Defense Annual Energy Management Report Fiscal Year 2014*, 11-12.

¹² *Ibid.*, 47.

¹³ *Ibid.*

Figure 4: EPAct 2005 Renewable Energy Goal Attainment



Source: DOD Annual Energy Management Report Fiscal Year 2014

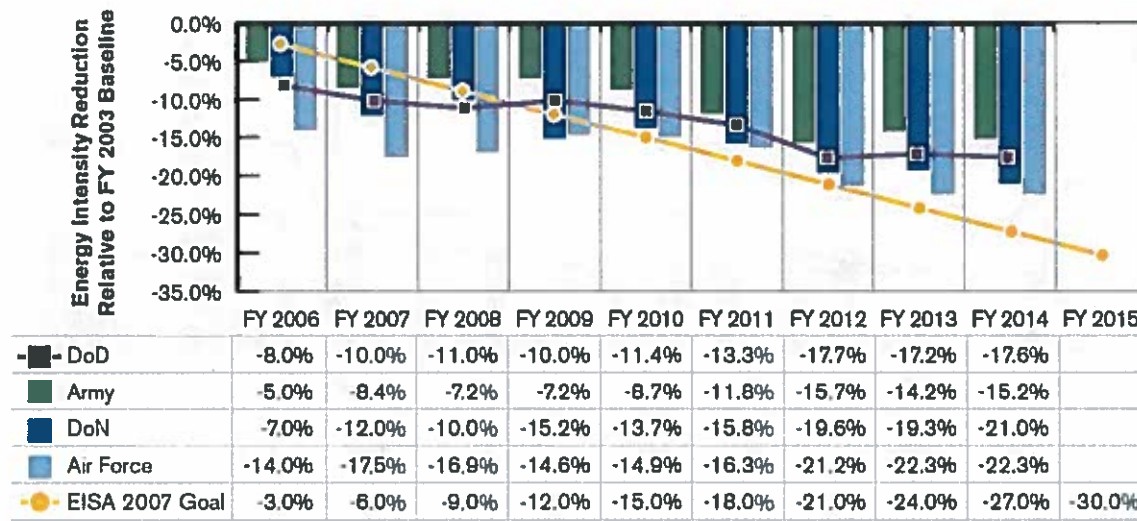
Reduce Demand

In FY 2014, the Army reduced its energy intensity (energy required for a process) by 15.2 % from its FY 2003 baseline, a 1 % reduction from FY 2013, but still failed to achieve the 27 % goal established by EISA 2007 (See Figure 5).¹⁴ The Army continued to employ combined heat and power (CHP) systems to improve its energy efficiency, which help meet reduction goals through source energy credits. In FY 2014, on-site source energy credits accounted for 1.7 % of the Army's energy intensity goal progress. These on-site projects contributed to improved energy efficiency and resilience at Army installations.¹⁵

¹⁴ Ibid., 23.

¹⁵ Ibid.

Figure 5: DOD Energy Intensity EISA 2007 Goal Attainment



Source: DOD Annual Energy Management Report Fiscal Year 2014

In FY 2014, the Army's petroleum consumption in fleet vehicles was 38.4 % below its FY 2005 baseline, exceeding the 30% goal well ahead of the FY 2020 goal suspense.¹⁶ Since FY 2011, the Army reduced its total fleet size by 15,000 vehicles, resulting in a current fleet of 30,500 alternative fuel and high efficiency vehicles.¹⁷ The Army used a multifaceted approach including right-sizing the fleet by eliminating under-utilized and unjustified vehicles along with downsizing the remaining vehicles in the fleet to the smallest vehicle able to perform the mission.

Adapt Future Forces and Technology

The Army recognized the growing importance of obtaining energy resilience on its installations and continued to work with various entities throughout DOD and industry to achieve resiliency. During FY 2014, the Army continued to improve the energy resilience posture of its installations and facilities through enhanced energy efficiency, improved

¹⁶ Ibid., 32.

¹⁷ Ibid.

physical and cyber grid infrastructure resilience, and development of on-site power generation. For instance, the Army used advanced metering technology at its facilities to gather accurate, real-time facility energy data providing a basis for effective enterprise and installation energy management. These efforts maintained the Army's focus on creating energy resilient installations.

The Army explored alternative solutions such as microgrids and renewable energy on its installations to the extent that all future new renewable energy projects will provide power through the local distribution system and be designed as an integrated microgrid. For example, the Fort Drum, NY biomass plant when complete will provide 100 % of the installation's electricity through on-site generation independent of the commercial power grid.¹⁸ While on-site generation may reduce some opportunities for renewable energy projects, the Army believes that energy resilience should be a primary objective in its energy efforts enabling energy security.¹⁹

In summary, the Army systematically moved toward achieving the Federal energy goals. Their efforts to increase the Service's energy efficiency and reduce consumption through leveraging new technologies are remarkable. Despite failing to achieve the FY 2014 energy goals, the Army expressed confidence that its comprehensive energy plan will enable achievement of future energy management goals. Unfortunately, the political, economic, and cultural risk factors hindering the complete implementation of DOD's energy strategy will degrade the success of the Army's energy plan. The Army is also

¹⁸ Ibid., 51.

¹⁹ On-site energy generation is more resilient because it reduces the installation's mission risk to extended electric power outages from local power grids. However, on-site generation decreases the opportunities to leverage off-site renewable resources due to grid interoperability challenges.

challenged with maintaining momentum toward achieving energy independence and availability, while simultaneously ensuring its operational readiness for the nation.

3.3 Air Force Installation Energy Supporting Efforts

The Air Force is the single largest consumer of energy in the Federal government and the second largest consumer of installation energy in DOD accounting for 30 % of DOD's total installation energy use.²⁰ While the abundance of the Air Force's energy consumed is largely aviation fuel, there are major mission energy requirements at the installations where the denial or loss of installation energy could have tactical, operational, and strategic consequences. The Air Force recognized its energy vulnerabilities and integrated energy considerations across the Air Force enterprise by focusing on four priorities: Improving Resiliency, Reducing Demand, Assuring Supply, and Fostering an Energy Aware Culture.²¹ These priorities provide the overarching framework for the Air Force's Strategic Energy Plan addressing every dimension of the energy challenges faced from security to supply and demand, as well as fostering a culture that values energy as a strategic resource. The Air Force's integration into DOD's installation sustainable energy strategy is paramount to achieving energy independence and availability. Unfortunately, the Air Force failed to fulfill the Federal energy goals due to political, economic, and cultural factors hindering the complete implementation of DOD's energy strategy.

²⁰ *Department of Defense Annual Energy Management Report Fiscal Year 2014*, 18.

²¹ Department of the Air Force, *U.S. Air Force Energy Strategic Plan*, Department of the Air Force (Washington DC, 2013), 3.

Expand Supply

In FY 2014, the Air Force failed to achieve the EPAct 2005 renewable energy goal of 7.5 %, consuming 5.7 % of its electricity from renewable energy sources (See Figure 5).²² The decrease from 8.0 % in FY 2013 can be attributed to the lack of Renewable Energy Credits (RECs) purchased in FY 2014. In FY 2013, the Air Force purchased over 320,000 MWh of RECs. The reduction in RECs purchased was DOD's effort to achieve an acceptable tradeoff between retaining RECs and taking advantage of the full economic benefits of RECs to encourage project development. While a solution, procuring unbundled RECs is not the preferred substitute for renewable energy production. As budgets decrease, the Service's ability to buy its way into achieving the standard through REC purchases will decline. Undeterred, the Air Force continues its progress toward the renewable energy goals by executing renewable energy projects and by purchasing commercial renewable energy. DOD should reevaluate the purchasing of RECs policy as budgetary uncertainties continue.

Reduce Demand

In FY 2014, the Air Force reduced energy intensity by 22.3 % from its FY 2003 baseline, staying consistent with their FY 2013 progress, but not achieving the 27 % EISA 2007 reduction goal (See Figure 6).²³ The Air Force also reduced its petroleum consumption by 11.4 % compared to its FY 2005 baseline, but failed to achieve the FY 2014 EISA 2007 goal of 18 %.²⁴ As a result of the failures, the Air Force implemented a variety of actions reducing petroleum use in non-tactical vehicles (NTVs), including the

²² *Department of Defense Annual Energy Management Report Fiscal Year 2014*, 41.

²³ *Ibid.*, 25.

²⁴ *Ibid.*, 33.

pursuit of alternative fuel use and right-sizing the fleet. In 2014, the Air Force right-sized the NTV fleet down to 775 vehicles after eliminating 1,941 vehicles from its inventory resulting in a reductions in petroleum consumption.²⁵ This right-sizing postured the Air Force to achieve the 2015 petroleum reduction goal of 30%.

Adapt Future Forces and Technology

The Air Force is accustomed to being on the cutting edge of technology and adapting its force to meet future requirements. The Air Force maintained that attitude as the service improved its ability to manage energy supply and demand in a way that enhanced mission capability and readiness while helping address DOD's and the Nation's broader energy challenges. The Air Force partnered throughout DOD and with local, regional, state, and Federal stakeholders to address energy resilience at Air Force installations. The Air Force focused on installation energy resilience and continued to identify energy requirements for critical missions, while developing and exercising response plans that contribute to a ready energy posture.

As the largest consumer of energy in DOD, the Air Force's energy efforts are critical to DOD's overall sustainable energy strategy. The Air Force's energy plan is solid; unfortunately, the political, economic, and cultural risk factors hindering the complete implementation of DOD's energy strategy will degrade the success of the Air Force's energy plan. The Air Force is addressing the cultural risk factor but requires DOD assistance to address the political and economic risk factors. Similar to the Army, the Air Force is also challenged with maintaining momentum toward achieving energy

²⁵ Ibid.

independence and availability, while simultaneously ensuring its operational readiness for the nation.

3.4 Navy Installation Energy Supporting Efforts

The Navy is the third largest consumer of installation energy accounting for 29 % of DOD's total installation energy use.²⁶ In efforts to support DOD's energy strategy, the Navy developed an energy plan around the goals set by the Secretary of the Navy (SECNAV) Ray Mabus. In 2009, the SECNAV issued a number of energy goals designed to increase energy security, promote energy efficiencies that improve warfighting capabilities, and reduce reliance on foreign sources of fossil fuels through investments in renewable energy, including biofuel and other alternative sources (wind, solar, and geothermal).²⁷ The SECNAV made security and independence the two energy priorities for the Navy. The SECNAV set five energy goals that drove the Navy's overall energy plan. Of the five goals, the three goals addressing installation energy use were: Increase Alternative Energy Ashore (on installations), Reduce Non-Tactical Petroleum Use, and Energy Efficient Acquisition.²⁸ The Navy aimed to achieve the SECNAV's goals by adopting energy efficient acquisition practices, technologies, and operations. The Navy is nested with DOD's energy strategy and making significant contributions to DOD's Installation Sustainable Energy Strategy. Unfortunately, like the Army and Air Force, the Navy failed to completely fulfill the Federal energy goals due to political,

²⁶ Ibid., 18.

²⁷ Department of the Navy, "Deputy Secretary of the Navy – Energy," Department of the Navy, <http://www.secnav.navy.mil/eie/Pages/Energy.aspx> (accessed November 29, 2015).

²⁸ Department of the Navy, *Department of the Navy Strategy for Renewable Energy*, Department of the Navy (Washington DC, 2012), 3.

economic, and cultural factors hindering complete implementation of DOD's energy strategy.

Expand Supply

In FY 2014, the Department of the Navy (DON) failed to achieve the EAct 2005 renewable energy goal of 7.5 %, consuming 3.5 % of electricity from renewable energy sources.²⁹ The Navy's progress against the EAct 2005 renewable goal was 2.1 %, while the Marine Corps exceeded the EAct 2005 renewable energy goal by achieving 9.1 % of electricity from renewable energy sources (See Figure 4).³⁰ The Marine Corps' success was a result of new on-site generation facilities starting operations in FY 2014. Despite the shortcomings on the EAct 2005 goal, the DON embarked on an aggressive renewable energy strategy to deploy 1 GW of renewable energy on or near its installations. For example, the Navy's China Lake geothermal power plant in California is DOD's largest renewable energy project supplying nearly half of DOD's renewable energy production.³¹ The 1 GW effort is designed to support the SECNAV's goal to obtain 50 % of all energy required from alternative sources such as solar, wind, biofuels, and geothermal energy by 2020. With the implementation of the 1 GW initiative, the EAct 2005 goals are achievable for DON.

Reduce Demand

In FY 2014, DON reduced energy intensity by 21 % relative to its FY 2003 baseline; unfortunately, these efforts still failed to achieve the EISA 2007 goal, if only by 6% (See Figure 6).³² DON is trending in the positive direction of reducing the department's energy

²⁹ *Department of Defense Annual Energy Management Report Fiscal Year 2014*, 47.

³⁰ *Ibid.*

³¹ *Ibid.*, 39.

³² *Department of Defense Annual Energy Management Report Fiscal Year 2014*, 24.

intensity, but must address the cultural risk factors in conjunction with receiving assistance from DOD in addressing political and economic risk factors to truly achieve the energy goals. Federal energy goal progress is expected by both the Navy and the Marine Corps in FY 2015 as projects awarded late in FY 2012 and FY 2013 begin to yield savings. As additional out year projects come online, DON will continue to improve its energy intensity goal progress.

DON's investment in thermal energy from the waste heat of cogeneration systems help to meet reduction goals through source energy credits. In FY 2014, on-site source energy credits accounted for 4.5 % of the Navy's energy intensity goal progress and 3.3 % of the Marine Corps' goal progress.³³ These on-site projects coupled with other initiatives contributed to improved energy efficiencies and resilience of DON installations. Also, the DON's petroleum consumption in fleet vehicles was 26.3 % below its FY 2005 baseline (Navy – 19.4 % and Marine Corps – 38 %) contributing to DOD satisfying the EISA 2007 goal.³⁴

Adapt Future Forces and Technology

The Navy's energy vision identified ends, ways, and means for increasing energy resilience. The SECNAV created a conducive energy resilience environment through his charge to the Department. The Navy focused on increasing installation energy resilience by decreasing overall energy consumption, increasing the energy efficiency of installation systems, increasing the use of viable alternative energy sources, and increasing the reliability of energy for critical infrastructure. For example, DON engaged in a joint venture with industry to build a Microgrid Test Facility at the Navy's Mobile

³³ Ibid.

³⁴ Ibid., 32.

Utilities Support Equipment Yard in Port Hueneme, California which conducted specific and controlled testing of microgrid concepts and components.³⁵ The Port Hueneme tests resulted in microgrid technology advances being implemented not only at Navy installations but across DOD. The Navy's enterprise-wide energy management program provides the necessary oversight to the Navy's installation energy program addressing risks to critical infrastructure and mission-critical utility infrastructure subsequently enabling the seamless integration into DOD's installation sustainable energy strategy.

The Navy is perhaps the most aggressive of all the Services in pursuit of a sustainable energy future. The Service is committed to the attainment of the SECNAV's energy goals focused on reducing energy consumption and increasing the use of alternative energy sources. DON is a critical enabling component to DOD's installation sustainable energy strategy. However, the Navy's ability to fully satisfy the Federal energy goals will continue to experience shortcomings until the political, economic, and cultural risk factors are addressed hindering full energy strategy implementation. In line with the other Services, the Navy faces the challenge of maintaining the momentum toward achieving energy independence and availability while simultaneously ensuring its operational readiness for the Nation.

In summary, DOD's existing installation sustainable energy strategy is not the military's traditional energy approach. The review of DOD's energy strategy revealed a clear understanding of the strategic risks associated with installation energy use and highlighted the challenges associated with the successful implementation of the installation sustainable energy strategy. DOD is committed to leveraging cutting edge

³⁵ Ibid., 52.

technology, seeking innovative financial sourcing, and embracing cultural change to achieve the strategy ends. The Department expressed confidence that its strategy's integrated three pillar design of expanding the energy supply through the use of sustainable sources, reducing the energy demand through conservation efforts, and adapting the future forces and technologies is capable of achieving the strategy ends of enhanced capability, mitigated costs, and decreased risk (energy security). The energy strategy is sound, but will not fulfill the Federal energy goals without addressing political, economic, and cultural risk factors hindering successful strategy implementation.

Chapter 4 – Risks to DOD’s Installation Sustainable Energy Strategy

Risks to achieving DOD’s installation sustainable energy strategy goals are primarily influenced by a combination of interconnected political, economic, and cultural factors hindering the complete strategy implementation. With varying degrees of success, DOD is implementing its energy strategy. However, DOD’s failure to achieve the Federal energy goals will continue until the political, economic, and cultural risk factors hindering the complete strategy implementation are addressed.

4.1 Political Risks

The political risks to DOD’s installation sustainable energy strategy exist at every level of government in the form of legislation. Federal and state energy legislation coupled with local energy (electricity) regulations present a significant challenge to DOD as the Department attempts to implement its energy strategy at installations across the US.¹ DOD faces the difficult task of implementing a holistic installation sustainable energy strategy in a dynamic political environment filled with multiple barriers hindering the strategy’s success.

For instance, Federal legislation sets clear mandates requiring DOD to produce or procure 25% of all energy from renewable sources by 2025.² DOD partnered with private sector developers using all available financing mechanisms such as third party Power

¹Practical Law, “Electricity regulation in the United States: overview,” <http://us.practicallaw.com/8-525-5799?source=relatedcontent> (accessed December 29, 2015)

²John Warner National Defense Authorization Act for Fiscal Year 2007, Sec. 2911.

Purchase Agreements (PPA) to satisfy the renewable energy mandate. These third party PPAs allowed developers to build, own, operate, and maintain renewable energy (RE) generation systems on, or near, a DOD property and sell power, and possibly RECs to DOD without the Department being burdened with the majority of the initial capital, and operation and maintenance expenses.³ Unfortunately, DOD's ability to maximize the advantages of PPAs is hindered by some state legislation.⁴ As of November 2012, at least twenty-two states, plus Washington, D.C. and Puerto Rico, authorize third party solar PPAs.⁵ In other states, legislation characterizes their electric utilities such that third party developers are subject to the administrative and regulatory requirements of the state, reducing the benefits offered by the partnerships.⁶ The additional administrative and regulatory requirements stipulated by some states stifles the collaboration between DOD and private developers, hindering the Department's ability to meet its renewable energy goals.

Under the concept of Federal supremacy, Federal legislation such as 10 U.S.C. § 2922a grants the secretary of a military department the authority to enter PPAs for terms of up to 30 years. This legislation classifies installations as "Federal enclaves," removing them from state jurisdiction and thus circumventing the state legislation.⁷ Despite having the authorities granted by Federal legislation, DOD is opting to nurture

³ U.S. Department of Energy, Clean Energy Application Center Southeast, *Barriers to Military Installations Utilizing Distributed Generation from Renewable Energy Resources: Third Party Power Purchase Agreements*, by Keith McAllister, U.S. Department of Energy (Raleigh, 2011), 2.

⁴ *Ibid.*

⁵ *Ibid.*, 3.

⁶ *Ibid.*, 6-8.

⁷ Amy S. Koch, "The Policy Context for Military Renewables: Rethinking State Regulatory Issues," *Renewable Energy for Military Installations: 2014 Industry Review*, (February 2014): 6-7, <http://acore.org/files/pdfs/Renewable-Energy-for-Military-Installations.pdf> (accessed December 29, 2015).

symbiotic partnerships with the states to increase renewable energy supply for fear of straining relationships with Congressional members.⁸ Unfortunately, DOD's unwillingness to create tensions with political leaders is hindering the Department's ability to maximize opportunities through PPAs and will result in continued failure to meet Federal energy goals.

4.2 Economic Risks

The two greatest economic risks to DOD's installation sustainable energy strategy are the uncertainty of the Department's future budgets and the impact of legislation on the financial instruments available to DOD. The majority of DOD's energy projects are funded through appropriations that are direct funding authorities consisting of military construction (MILCON); Sustainment, Restoration, and Modernization (SRM); Operation and Maintenance (O&M); and Defense Working Capital Fund (DWCF) accounts. In 2014, Congress appropriated just under \$800 million to DOD for energy projects resulting in the funding of 1,283 projects.⁹ The funding distribution was 82 % for energy conservation projects, 12 % for renewable energy projects, and 6 % for water conservation projects.¹⁰ Of note, the 2014 energy project appropriation allocated no funding for energy security projects, one of the ends to DOD's installation energy strategy, highlighting the economic impact on strategy implementation. As DOD's budget continues to decrease under the Budget Control Act, the Department must make

⁸ Ibid., 10.

⁹ *Department of Defense Annual Energy Management Report Fiscal Year 2014*, 63.

¹⁰ Ibid.

some long term decisions about its energy strategy with a focus on achieving energy independence and availability.

As a result of decreasing appropriations budget, DOD increasingly relied on third party financing mechanisms such as Utility Energy Services Contracts (UESC) and Energy Savings Performance Contracts (ESPC) in order to meet its energy goals.¹¹ These financing mechanisms allowed for the implementation of energy efficiency, renewable, and distributed energy projects, as well as energy resilience projects without up-front appropriated funds while using the cost savings to repay the private capital over time.¹² In FY 2014, DOD awarded nearly \$375 million in non-governmental third party financed ESPCs and UESCs, equating to 30 % of DOD's total energy project investments.¹³ These third party financed contracts allowed DOD to fund additional energy projects not budgeted in the FY 2014 appropriated funds, moving the Department closer to achieving Federal energy goals. Managing the risks associated with the third party financing mechanisms along with maintaining investor confidence as energy tax credits and incentives expire are critical to the future success of DOD's energy strategy. DOD is responsible for clearly articulating the economic risk impacts on its energy strategy to Congress. More importantly, DOD must articulate the relationship between its installation energy strategy and the Department's ability to assure national security. The economic risks to DOD's installation sustainable energy strategy resulting from budgetary uncertainty and legislative turmoil are enduring. However, DOD is uniquely

¹¹ Ibid., 67.

¹² Ibid.

¹³ Ibid.

positioned to seize the economic benefits and opportunities associated with sustainable energy procurement and production given the Department's vast buying power.

4.3 Cultural Risks

The cultural risks to DOD's installation sustainable energy strategy come from within the organization. DOD built its reputation on protecting the Nation. However, protecting the Nation rarely occurs in the most efficient manner. Therefore, addressing the cultural risks to DOD's energy strategy requires a mindset change for the oldest and largest government agency with an emphasis on being both efficient and effective. The Department envisioned sustainability being interwoven into the everyday fabric of the DOD mission.¹⁴ This vision required the organization's increased understanding of energy and its impact to the mission down to the individual level. This understanding provided the sense of urgency necessary to influence a change in organizational culture.

The change in organizational culture is critical to the successful implementation of DOD's energy strategy. The Air Force's effort of fostering an energy aware culture demonstrated a great initiative focused on addressing the cultural risk factor.¹⁵ DOD created an environment for change and is striving to implement the required changes. Internally, DOD is on glide path to mitigating the cultural risks to its strategy implementation. Unfortunately, not all stakeholders impacting DOD's energy strategy view the Department's cultural change the same. For example, during Congressional

¹⁴ *Strategic Sustainability Performance Plan: FY 2014, ES-1.*

¹⁵ Department of the Air Force, *U.S. Air Force Energy Strategic Plan*, Department of the Air Force (Washington DC, 2013), 16.

Hearing in 2012, SECNAV Mabus was badgered by members of Congress for the Navy attempting a biofuel initiative that would assist in achieving the Federal energy goals at the expense of building more ships. This example highlights the interconnectedness of political, economic, and cultural risk factors that must be addressed before DOD could achieve Federal energy goals.

Chapter 5 – Research Findings, Recommendations, and Conclusion

5.1 Research Findings

This research effort focused on determining whether DOD's existing installation sustainable energy strategy was fulfilling the Federal energy goals. This research also revealed valuable insights about DOD's energy strategy implementation. For all its effort, DOD's energy strategy fulfills only 3 of 5 Federal energy goals. The following list presents research findings in relation to the installation energy goals, along with an explanation for the shortfalls.¹

- Reduce Facility Energy Intensity relative to FY 2003 baseline (EISA 2007)
 - DOD failed to achieve the FY 2014 reduction goals of 27 % by only achieving a 17.6 % energy intensity reduction from the FY 2003 baseline.
 - The facility energy intensity goal failure is attributed to the budget sequestration and delayed appropriations resulting in reduced energy projects. (Political Risk)
- Consume more electric energy from renewable sources (EPA Act 2005)
 - DOD failed to achieve the FY 2014 renewable consumption goals of 7.5 % by only consuming 3.5 % of its energy from renewable sources.
 - The energy from renewable sources goal failure is attributed to difficulties implementing third-party financial mechanism (ESPC/UESC) leading to a reduction energy projects. (Economic Risk)
- Produce or procure more energy from renewable sources (10 U.S.C. 2911(e))
 - DOD made steady progress toward achieving the 25 % by 2025 goal.
- Reduce Potable Water Intensity relative to FY 2007 baseline (EO 13423)
 - DOD achieved a 21.5 % reduction exceeding the 14 % FY 2014 goal.

¹ Department of Defense Annual Energy Management Report Fiscal Year 2014, 9.

- Reduce Petroleum Consumption in non-tactical vehicles relative to FY 2005 baseline (EISA 2007, EO 13514)
 - DOD achieved a 30.2 % reduction exceeding the 18 % FY 2014 goal.

Figure 6: DOD and Service Components Energy Plan Comparison

ORG	Energy Plan Objectives	Strategy Ends
DOD	<ul style="list-style-type: none"> - Expand Supply - Reduce Demand - Adapt Future Forces and Technology 	<ul style="list-style-type: none"> - Enhance Capability - Mitigate Cost - Decrease Risk
Army	<ul style="list-style-type: none"> - Eliminate energy waste in existing facilities (R)(E) - Increase energy efficiency in new construction and renovations (R)(A) - Reduce dependence on fossil fuels (E)(R) - Conserve water resources (R) - Improve energy security 	
Air Force	<ul style="list-style-type: none"> - Improve Resiliency - Reduce Demand (R) - Assure Supply (E)(A) - Foster an Energy Aware Culture (R) 	
Navy	<ul style="list-style-type: none"> - Increase Alternative Energy Use DON Wide (E) - Increase Alternative Energy Ashore (on installations) (E)(A) - Reduce Non-Tactical Petroleum Use (R)(A) - Sail the “Great Green Fleet” (E)(R)(A) - Energy Efficient Acquisition (R) 	
Legend: Expand Supply (E); Reduce Demand (R); Adapt Future Force and Technology (A)		

The energy plans analysis discovered that the Service Components’ plan objectives are generally supporting and reinforcing of DOD’s plan (see Figure 6). Of note, DOD’s plan omits any focused actions addressing cultural change. However, the Service Components address changing organizational culture as a requirement in their energy plans. The Air Force went to the extent of including “Foster an Energy Aware Culture” as a line of effort in its plan. Despite being generally supporting and reinforcing of DOD’s plan, there is evidence of a prioritization problem. For example, the Army and the Air Force view

attainment of the EPC Act 2005 renewable energy consumption goals differently. The Army focused on building renewable energy projects as the method to satisfying the requirements whereas the Air Force prefers to purchase RECs to satisfy the goal requirements. The Air Force failed to achieve the renewable energy consumption goals due to their inability to purchase RECs. Currently, both methods are accepted by DOD. However, purchasing RECs as the sole form of renewable energy consumption is counter to DOD's energy resilience efforts. DODI 4170.11 provides oversight guidance to the Services allowing leeway in the internal management of energy programs. However, this example highlights a need for DOD to amend the guidance limiting the leeway granted to Services when DOD's strategy goals are jeopardized due to Service mismanagement.

5.2 Recommendations

To correct the noted shortfalls, this study recommends adjustments to DOD's installation sustainable energy strategy focused around People, Money, and Politics. The adjustments will posture the Department to achieve the Federal energy goals.

Recommendation 1 (People): DOD must commit to changing the organizational culture in order to foster an environment where sustainability is truly woven into the everyday fabric of the DOD mission.

Change in the organizational culture starts with a vision that resonates and creates an urgency for change in people. DOD must demonstrate to its people why sustainable energy is important. A cursory reference to the organizational culture highlighted in DOD's Strategic Sustainability Performance Plan will not suffice. Similar to the Air

Force, DOD needs to commit to “Fostering an energy aware culture” as a dedicated line of effort with associated objectives focused on achieving the strategy ends. DOD must realize that the strategy’s success depends on the people executing the plan. There is evidence of a changing culture at the installations; however, DOD must seize this opportunity by cultivating the change through education, incentives, and empowerment of installation leaders to promote the vision. The Department should model the approach used to implement the “Resident Pay Utility Program” (RPUP) at the military installations.² Installation leaders educated residents about the program highlighting the benefits. Initially, RPUP encountered immense resistance, but the culture changed as empowered leaders educated residents on the benefits of the program while incentives strengthen the message. DOD’s line of effort to address the cultural risk factor should include objectives for education, incentives, and installation leader empowerment. The complete implementation of the installation sustainable energy strategy will depend on individuals acting in an energy aware culture.

Recommendation 2 (Money): As the single largest national energy consumer, DOD must leverage its buying power in negotiating lower utility rates for the installations.

DOD consumes a considerable amount of energy. The Department should consolidate its energy requirements across Services to negotiate for better utility rates in certain areas. For example, there are multiple installations from various Services requiring energy in

² RPUP is a DOD program designed to reduce energy use by installation residents requiring payment for energy usage above an established baseline. Prior to RPUP, installation residents forfeited their basic allowance for housing that covered all utility expenses. RPUP’s savings are reinvested into housing improvements and amenities on the installations.

Florida; unfortunately, PPA use is prohibited in Florida.³ In this situation, DOD should consolidate all Service energy requirements and negotiate from a position of strength, seeking more advantageous utility rates or an exception to the state's PPA legislation. As budgets decrease, DOD has to seek other non-conventional cost saving measures through consolidating the Department's purchasing power.

Recommendation 3 (Politics): DOD should reconsider its approach in exercising “Federal enclave” authorities with respect to installations as the Department seeks greater opportunities to purchase renewable energy.

DOD exhibits reluctance to enact the “Federal enclave” authority exempting an installation from state utility law franchise requirements.⁴ The political tensions created at the state and Federal level influence DOD's reluctance to enact the authorities. This reluctance is reducing opportunities to expand the energy supply through partnerships, subsequently degrading the Department's ability to achieve the Federal energy goals. DOD must clearly articulate the benefits of enacting the “Federal enclave” authority to Congressional members while nurturing the relationships in the targeted states. DOD must maximize every opportunity to expand energy sources focused on fulfillment of Federal energy goals.

³ McAllister, *Barriers to Military Installations Utilizing Distributed Generation from Renewable Energy Resources*, 3.

⁴ Koch, “The Policy Context for Military Renewables,” 7.

5.3 Conclusion

The 1973 energy crisis changed the US mindset about energy availability forever. No longer could the US ignore the threat to national security presented by the lack of available energy. Energy availability became an economic and national security issue prompting Congress to create legislation aimed at insulating the nation from the risks. As the Federal agency responsible for national security and the Federal government's largest consumer of energy, DOD quickly accepted its vital role in the Nation's energy independence and availability efforts. DOD also acknowledged the critical role of its installations to the Department's ability to fight and win wars. As a result, DOD aggressively pursued an installation sustainable energy strategy focused on energy independence and availability while fulfilling Federal energy goals.

Despite the thoroughness of DOD's energy strategy, the Department only partially fulfilled the Federal energy goals. The review of DOD's energy strategy revealed political, economic, and cultural risk factors that contributed to the strategy's shortfalls. DOD's implementation of the recommended strategy adjustments will posture the Department to achieve the Federal energy goals while staying of glide path to obtain energy independence and availability.

DOD is making great strides toward achieving energy independence and availability. However, the Department's ability to maintain reliable, uninterrupted energy for its installations will depend on the Department's commitment to fostering an energy aware culture, leveraging alternative financing mechanisms, and engaging Congress and other stakeholders to maximize the use of all available resources.

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Acronyms

ASA (IE&E) - Assistant Secretary of the Army for Installations, Energy and Environment

CHP - Combined heat and power

DOD - Department of Defense

DODD - DOD Directive

DODI - DOD Instructions

DOE - Department of Energy

DON - Department of the Navy

DSB - Defense Science Board

DWCF - Defense Working Capital Fund

EISA - Energy Independence and Security Act

EO - Executive Order

EPAct - Energy Policy Act

ESPC - Energy Savings Performance Contracts

GW – Gigawatts

KWh - Kilowatt hour

LEED - Leadership in Energy & Environmental Design

MILCON - Military construction

NECPA - National Energy Conservation Policy Act

NTV - Non-tactical vehicles

OEI - Office of Energy Initiative

O&M - Operation and Maintenance

OPEC - Organization of Petroleum Exporting Countries

PPA - Power Purchase Agreements

PV - Photovoltaic

RE - Renewable energy

REC - Renewable Energy Credits

RPUP - Resident Pay Utility Program

SECNAV - Secretary of the Navy

SESC - Senior Energy and Sustainability Council

SRM - Sustainment, Restoration, and Modernization

UESC - Utility Energy Services Contracts

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Vita

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